

CLAIMS

1. A measurement device comprising:

2 a sensor having a probe section and configured and arranged to output a
plurality of measurement signals, each of said plurality of measurement signals
4 representing an effect of an energy field emanating from a source on said probe
section at a corresponding one of a plurality of positional relationships between
6 said probe section and said source in three dimensions;

a positioning device configured and arranged to controllably create said
8 plurality of positional relationships; and

a processing unit configured and arranged to receive data based on the
10 measurement signals and positional information related to the plurality of
positional relationships and outputting a field characterization,

12 wherein the field characterization comprises a representation of a three-
dimensional nature of the effect of the energy field on said probe section.

2. The measurement device according to claim 1, wherein the
2 energy field is an electric field.

3. The measurement device according to claim 1, wherein the
2 energy field is a magnetic field.

4. The measurement device according to claim 1, wherein the
2 energy field is an thermal field.

5. The apparatus according to claim 1, one of the three dimensions
2 being an orientation in a plane defined by the other two of the three dimensions.

6. The measurement device according to claim 5, wherein said
2 sensor rotates about an axis perpendicular to a surface of the source.

7. The measurement device according to claim 1, said sensor
2 comprising an active device.

8. The measurement device according to claim 1, wherein a brittle
2 element extends between the probe section and a body of the sensor.

9. The measurement device according to claim 1, said probe section
2 comprising two plates, wherein each of said plurality of data signals is derived
from a capacitance between the plates.

10. The measurement device according to claim 1, said probe section
2 comprising a ball, wherein a diameter of the ball is electrically small.

11. The measurement device according to claim 1, said sensor
2 including at least one among a matching network, an amplifier, and a filter.

12. The measurement device according to claim 1, further comprising
2 a registration unit configured and arranged to indicate an orientation of said
sensor relative to the source.

13. The measurement device according to claim 12, said registration
2 unit comprising a laser-emitting device.

14. The measurement device according to claim 1, wherein the
2 processing unit is configured and arranged to compensate for predetermined
aspects of a signal path between the probe section and the processing unit.

15. A method comprising:

2 controllably creating a plurality of positional relationships in three
dimensions between a sensor and a source of a field, said sensor outputting a
4 plurality of measurement signals corresponding to each of said plurality of
positional relationships, each of said data signals being representative of an
6 effect of the field on said sensor at a corresponding one of said plurality of
positional relationships; and

8 processing the measurement signals from said sensor in combination
with positional information related to said plurality of positional relationships to
10 obtain a representation of a three-dimensional nature of the effect of the field on
said sensor.

16. The method according to claim 15, wherein said sensor is a
2 magnetic field sensor.

17. The method according to claim 15, wherein said sensor is an
2 electric field sensor.

18. The method according to claim 15, wherein said sensor is a
2 thermal sensor.

19. The method according to claim 15, wherein said sensor is an
2 operating electronic device.

20. The method according to claim 15, one of the three dimensions
2 being an orientation in a plane defined by the other two of the three dimensions.

21. The method according to claim 15, wherein a spectrum analyzer is
2 used to process the data signals.

22. The method according to claim 15, wherein processing the data
2 signals comprises compensating for predetermined aspects of a path over
which the data signals are transmitted by said sensor.

23. A method of obtaining emissions data, said method comprising:
2 receiving a first measurement signal from a sensor, the first
measurement signal being representative of an effect on the sensor of an
4 electromagnetic field emitted by a device under test;

selecting a frequency at which a magnitude of the first measurement
6 signal exceeds a predetermined threshold;

controllably creating a plurality of positional relationships between the
8 sensor and the device under test;

for each among the plurality of positional relationships, receiving a
10 second measurement signal representative of an effect on the sensor of an
electromagnetic field emitted by the device under test; and

- 12 for each of the second measurement signals, determining a quality of the second measurement signal at the selected frequency.

24. The method of obtaining emissions data according to claim 23,
2 wherein receiving a first measurement signal includes applying a transfer function of the sensor to the signal.

25. The method of obtaining emissions data according to claim 23,
2 wherein receiving a second measurement signal includes applying a transfer function of the sensor to the signal.

26. The method of obtaining emissions data according to claim 23,
2 wherein receiving a first measurement signal includes moving a scanning window of a spectrum analyzer across a predetermined frequency range.

27. The method of obtaining emissions data according to claim 23,
2 wherein selecting a frequency includes determining the magnitude of the first measurement signal in a scanning window and moving the scanning window
4 across a range of frequencies.

28. The method of obtaining emissions data according to claim 23,
2 wherein determining a quality of the second measurement signal includes determining a spatial direction of the electromagnetic field.

29. The method of obtaining emissions data according to claim 23,
2 wherein the electromagnetic field includes a magnetic field, and

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- wherein determining a quality of the second measurement signal
- 4 includes determining a direction of the magnetic field.

30. The method of obtaining emissions data according to claim 23,
- 2 wherein determining a quality of the second measurement signal includes determining a magnitude of the electromagnetic field.

31. The method of obtaining emissions data according to claim 23,
- 2 wherein receiving at least one of a first and second measurement signal includes inputting an excitation signal to the device under test.

32. The method of obtaining emissions data according to claim 31,
- 2 wherein receiving at least one of a first and second measurement signal includes varying a quality of the excitation signal.

33. The method of obtaining emissions data according to claim 32,
- 2 wherein receiving at least one of a first second measurement signal includes varying a frequency of the excitation signal.

34. A method of obtaining emissions data, said method comprising:
- 2 controllably creating a plurality of positional relationships between a sensor and a source of a field;
- 4 receiving a plurality of measurement signals from the sensor, each measurement signal corresponding to a different one of the positional
- 6 relationships and being representative of an effect of the field on the sensor at the corresponding positional relationship;

8 for each of the positional relationships, obtaining a data value from the
corresponding data signal, the data value being based on a magnitude and a
10 direction of a vector characterizing the field.

35. The method of obtaining emissions data according to claim 34,
2 wherein the data values are based on components of a predetermined
frequency.

36. The method of obtaining emissions data according to claim 34,
2 wherein controllably creating a plurality of positional relationships includes
rotating the sensor in relation to the source.

37. The method of obtaining emissions data according to claim 34,
2 wherein controllably creating the plurality of positional relationships includes
moving the sensor to a corresponding plurality of positions in a plane
4 substantially parallel to a surface of the source.

38. The method of obtaining emissions data according to claim 34,
2 wherein receiving a plurality of measurement signals includes applying a
transfer function of the sensor to a signal received from the sensor.

39. The method of obtaining emissions data according to claim 38,
2 wherein the transfer function of the sensor is a function of frequency.

40. The method of obtaining emissions data according to claim 38,
2 further comprising calibrating the sensor using a reference field source to obtain
the transfer function of the sensor.

41. The method of obtaining emissions data according to claim 34,
2 wherein receiving a plurality of measurement signals includes compensating for
cable losses in a signal received from the sensor.

42. The method of obtaining emissions data according to claim 34,
2 wherein obtaining a data value includes inputting the corresponding data signal
to a detector.

43. The method of obtaining emissions data according to claim 42,
2 wherein the detector includes a tuned receiver.

44. A method of obtaining emissions data, said method comprising:

2 controllably creating a plurality of positional relationships between a sensor and a source of a field;

4 receiving a plurality of measurement signals from the sensor, each measurement signal corresponding to a different one of the positional

6 relationships and being representative of an effect of the field on the sensor at the corresponding positional relationship;

8 for each of the positional relationships, obtaining a data value from the corresponding data signal; and

10 outputting a representation of the field in at least three dimensions based on the data values.

45. The method of obtaining emissions data according to claim 44,
2 wherein each data value is associated with a position of the sensor in a
predetermined plane, and

4 wherein each data value includes a magnitude and a direction of a vector
characterizing the field at the corresponding position.

46. The method of obtaining emissions data according to claim 44,
2 wherein outputting a representation of the field includes displaying the
representation of the field.

47. The method of obtaining emissions data according to claim 46,
2 wherein displaying the representation of the field includes displaying a false-
color representation of the field.

48. The method of obtaining emissions data according to claim 46,
2 wherein displaying the representation of the field includes displaying an image
of at least one of the source and an outline of the source in tandem with the
4 representation of the field.

49. The method of obtaining emissions data according to claim 48,
2 wherein displaying the representation of the field includes displaying a
correspondence between a point within the image of the source and a point
4 within the representation of the field.

50. The method of obtaining emissions data according to claim 45,
2 further comprising inputting an excitation signal to the source, wherein the field
is based at least in part on the excitation signal.

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51. The method of obtaining emissions data according to claim 50,
2 wherein inputting an excitation signal to the source includes controlling at least
one among a frequency and an amplitude of the excitation signal.

52. A method of obtaining susceptibility data, said method comprising:
2 positioning a source of a field in proximity to an electronic device;
varying a quality of the field;
4 receiving a plurality of data signals from the electronic device, each data
signal corresponding to a different value of the quality of the field and being
6 representative of an effect of the field on the electronic device.

53. The method of obtaining susceptibility data according to claim 52,
2 wherein the source of the field comprises an antenna, and
wherein obtaining a corresponding data value comprises applying a
4 transfer function of the antenna.

54. The method of obtaining susceptibility data according to claim 52,
2 wherein positioning a source of a field comprises controllably moving the source
in a predetermined path during said receiving a plurality of data signals.

55. The method of obtaining susceptibility data according to claim 52,
2 wherein varying a quality of the field includes varying an intensity of the field.

56. The method of obtaining susceptibility data according to claim 52,
2 wherein varying a quality of the field includes varying a frequency of the field.

57. The method of obtaining susceptibility data according to claim 52,
2 wherein receiving a plurality of data signals comprises receiving data signals
from a plurality of pins of the electronic device.

58. The method of obtaining susceptibility data according to claim 52,
2 wherein each data signal is based on a voltage induced by the field.

59. The measurement device according to claim 1, said probe section
2 comprising an active device.

60. The measurement device according to claim 8, wherein the brittle
2 element comprises a glass tube.

61. The measurement device according to claim 8, wherein the brittle
2 element encircles a portion of the signal path between the probe section and
the body of the sensor.

62. The measurement device according to claim 12, wherein the
2 registration unit comprises an imaging device.

63. The measurement device according to claim 1, wherein at least
2 one of the positioning device and the processing unit includes a recognition

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- 4 mechanism configured and arranged to determine a characteristic of the sensor.

- 2 64. The measurement device according to claim 1, wherein a signal path between the probe section and the processing unit includes a balanced transmission line.

- 2 65. The measurement device according to claim 1, wherein the signal path includes a twisted-pair line.

- 2 66. The measurement device according to claim 1, wherein a twist angle of the twisted-pair line varies from one end of the twisted-pair line to another.

- 2 67. The measurement device according to claim 1, wherein the sensor includes a conditioning circuit.

- 2 68. The measurement device according to claim 1, wherein the conditioning circuit includes a differential amplifier.

- 2 69. The measurement device according to claim 1, wherein the probe section includes an etched loop.

- 2 70. The measurement device according to claim 1, wherein the probe section includes etched plates.

71. The measurement device according to claim 1, wherein the probe
2 section includes at least one microelectromechanical element.

72. The measurement device according to claim 1, wherein a signal
2 path between the probe section and the processing unit includes a rotary
connector.

73. The measurement device according to claim 1, wherein a signal
2 path between the probe section and the processing unit includes a bias tee
configured and arranged to receive a DC signal.

74. A method of measuring a vector field, said method comprising:

2 controllably creating a plurality of positional relationships in three dimensions between a sensor and a source of a field,

4 at each positional relationship, rotating the sensor with respect to the source and receiving a plurality of measurement signals, each of said

6 measurement signals being representative of an effect of the field on said sensor at the positional relationship; and

8 for each positional relationship, processing the corresponding measurement signals to obtain a representation of a vector field emanating from

10 the source.

75. The method of measuring a vector field according to claim 74,
2 wherein the representation of a vector field includes a magnitude and direction
of the vector field.

76. The method of measuring a vector field according to claim 74,
2 wherein processing the corresponding measurement signals includes inputting
data based on the measurement signals to a tuned receiver.

77. The method of measuring a vector field according to claim 76,
2 wherein the tuned receiver comprises a spectrum analyzer.

78. The method of measuring a vector field according to claim 74,
2 wherein rotating the sensor includes detecting a home position of the sensor.

79. The method of measuring a vector field according to claim 78,
2 wherein processing the corresponding measurement signals includes sampling
the corresponding measurement signals using an analog-to-digital converter,
4 wherein a sampling operation of the analog-to-digital converter is synchronized
with said detecting a home position of the sensor.

80. The method of obtaining emissions data according to claim 23,
2 wherein receiving a measurement signal includes incrementing the span of a
spectrum analyzer across a predetermined frequency range.

81. The method of obtaining emissions data according to claim 23,
2 wherein selecting a frequency includes determining the magnitude of the
measurement signal in a window and moving the window across a range of
4 frequencies.

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85. The measurement device according to claim 67, wherein a twist
2 angle of a twisted-pair line between the probe section and the conditioning
circuit is selected to match an impedance of at least one of the probe section
4 and the conditioning circuit.